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ABSTRACT

There is abundant theoretical support for the value of Developmentally Appropriate Practice (DAP) at the elementary school level, but there has been relatively little research to document its effects. This paper explores the relationship between DAP and student achievement among low-income students in St. Paul, Minnesota, using research from an on-going evaluation of the Head Start-Public School Early Childhood Transition Demonstration Project. The degree of implementation of DAP in kindergarten, first, and second grades, and its relationship to student achievement were studied, and whether there were differential effects on the Hmong student population was investigated. Two clusters of elementary schools, six in all, were studied, with the Demonstration project implemented in one cluster. The preliminary results from this study indicate that there are significant relationships between DAP in the classroom and early student achievement in mathematics and reading. The positive relationships occurred across cultural groups in the sample. Even though the degree of DAP implementation overall was relatively modest, impacts on achievement and teacher attitudes were apparent. (Contains 3 tables and 14 references.) (SLD)

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DEVELOPMENTALLY APPROPRIATE PRACTICE AND STUDENT ACHIEVEMENT IN INNER-CITY ELEMENTARY SCHOOLS*

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DEVELOPMENTALLY APPROPRIATE PRACTICE AND STUDENT ACHIEVEMENT IN INNER-CITY ELEMENTARY SCHOOLS

The beneficial effects of classroom environments and teacher-child interaction which promote child-initiated exploration of age-appropriate materials have long been documented in preschool settings (Piaget, 1962; Schweinhart, Consortium for Longitudinal Studies, 1983; Pellegrini, 1983; Elkind, 1986; Kagan, 1989; Morrow and Rand, 1991). Currently, the press for greater implementation of curriculum and programming incorporating such developmentally appropriate practice into early elementary grade classrooms reflects a major shift within elementary education nationally (Braedekamp, 1987 Elkind, 1989). Drawing upon child development and early education research, there is abundant conceptual and theoretical support for the value of developmentally appropriate practice (DAP) at the elementary school level. Nevertheless, there has been relatively little research to date documenting the effects of DAP implementation upon academic achievement in the elementary grades (Gutierrex and Slvain, 1992). In addition, some educators have questioned whether DAP effectively serves children with special needs and/or from diverse cultural/ethnic backgrounds (Carta, Schwarz, Atwater and McConnell, 1991; Ogbu, 1981).

This paper explores the relationship between DAP and student achievement among low-income students in St. Paul, Minnesota. The research on which this paper is based is part of the ongoing evaluation of the St. Paul Head Start-Public School Early Childhood Transition Demonstration Project. We examine the degree of implementation of DAP in kindergarten, first and second grade study classrooms, as well as the potential relationship of DAP to student achievement. In addition, we examine whether there are differential effects of DAP upon the academic achievement of the sizable Hmong student population in our study sample compared to non-Hmong study children.

BACKGROUND

One of the key components of the National Head Start-Public School Transition Demonstration Project is the implementation of DAP in kindergarten through third grade. DAP represents the kind of curricular continuity, child-guided learning and attention to individual and group needs advocated by the framers of this national demonstration project. Findings from the first two operational years of the St. Paul Transition Project (1992-93, 1993-94) suggested that progress was being made in the implementation of several components of DAP in kindergarten and first grade classrooms. Additional analyses suggested a linkage between DAP and academic achievement of first grade students.

In this report, we will further examine these patterns and add data from the third operational year of the Transition Project (1994-95). Findings will be discussed in the context of the evidence they provide for DAP implementation at the elementary level in inner-city schools.

STUDY DESIGN

School Clusters and DAP Teacher Training. For purposes of research design, there are two clusters of three elementary schools (a total of six schools) in the study. These two clusters were developed so that they would be similar in total student enrollment and demographic characteristics (e.g., students' family income level, ethnicity). The selection of one cluster as Demonstration (where the Transition Project would be implemented) and the other as Comparison was done by random assignment.

Teachers in kindergarten through third grades in Demonstration schools have received Transition-sponsored training in the area of DAP. Some of this training has been directed by a certified High/Scope trainer and focused upon the theoretical background and practical implications of developmentally appropriate practice. In addition, participating teachers received developmentally appropriate materials for use in their classrooms.

Study Sample. Two cohorts of children and their families are studied longitudinally in all six schools as part of the National Transition Study. Cohort I children entered kindergarten in the 1992-93 school year (248 children), and Cohort II students entered kindergarten in the 1993-94 school year (280 children). Each cohort is composed of all entering kindergarten students who attended Head Start, as well as an equal-sized sample of children who did not attend Head Start. This non-Head Start group was drawn from the same classrooms as the Head Start children, and stratified random sampling was used to ensure similarity of gender, income and ethnic background (Hmong, other) to the Head Start sample. In St. Paul, a growing number of children and families participating in Head Start programs are recent Southeast Asian immigrants (i.e., Hmong) from Laos and Thailand. Therefore, nearly half of our study sample is Hmong (46%).

Measurement. Levels of DAP implementation in the study classrooms are measured through mid-year classroom observations using the Assessment Profile of Early Childhood Programs-Research Version (Abbott-Shim and Sibley, 1992). This observational tool is part of the National Core Data Set (i.e., it is used by all sites in the National Transition Study), and seeks to measure those aspects of the learning environment, scheduling, curriculum, interaction and individualization that best characterize DAP according to the NAEYC position guidelines (Braedekamp, 1987). The instrument involves rating a series of yes-no items that make up the following five scales:

1. Learning environment. Degree to which the classroom: has materials that encourage a variety of learning experiences, is arranged to encourage child independence, and reflects the child as an individual.

2. Scheduling. Degree to which scheduling and planning occur, and the degree to which the written schedule and actual classroom activities reflect variety.

3. Curriculum. Degree to which the teacher fosters multicultural sensitivity and appreciation, alternative teaching techniques are used to facilitate learning, children are encouraged to be active in guiding their own learning, and the curriculum is individualized.

4. Interacting. The degree to which the teacher initiates positive interactions with children, is responsive to children, and positively manages children's behavior; and the degree to which children seem happy and involved in activities.

5. Individualizing. The degree to which child assessment occurs systematically and is used for planning individualized experiences, and the degree to which the teacher has a system for identifying and making provisions in the classroom for children with special needs.

Scale scores (mean of 50, standard deviation of 10) were calculated for each of the five scales for data analysis purposes. Higher scores indicate more developmentally appropriate practices.

For purposes of data analysis, each study student was assigned Assessment Profile scores based on the classroom attended. Data are only available on students who continued to attend classrooms in study schools. Because of considerable mobility this number is much lower than the original cohort sizes.

Student achievement is measured through one-to-one administration of the Broad Reading (Letter-Word Identification, Passage Comprehension) and Broad Mathematics (Calculation, Applied Problems) sections of the Woodcock-Johnson battery (1990). Children are assessed in the fall and spring of their kindergarten year, and each subsequent spring through third grade.

Data Analysis. To address the study questions, comparisons of DAP implementation in the kindergarten, first and second grade classrooms in Demonstration and Comparison schools will be carried out. It is hypothesized that Demonstration classrooms will exhibit higher levels of DAP implementation, especially in the areas of classroom environment, curriculum and availability and access to materials. The relationship of DAP implementation levels to student achievement will also be examined. It is predicted that higher levels of DAP implementation will be positively correlated with higher student achievement. In addition, analyses will be done to determine whether DAP implementation levels have differential effects upon the achievement of Hmong and non-Hmong students. Limitations of the findings as well as their possible implications for DAP in the early elementary grades will be discussed.

FINDINGS

DAP by Treatment Condition

Differences were examined in average Assessment Profile scale scores by treatment condition (Demonstration vs. Comparison) for the first three operational years of the Transition Project. In these years, efforts were made to encourage and support DAP implementation, starting with kindergarten in the first year (1992-93), first grade in the second year (1993-94) and second grade in the third year (1994-95). Average scale scores and differences in these scores between Demonstration and Comparison classrooms (Demonstration minus

Comparison scores) by grade and year are indicated in Table 1 and 2, respectively. Twenty-one of the 25 difference scores (84%) shown in Table 2 were in a positive direction, including eight that were statistically significant ($p<.05$, two-tailed test). Positive difference scores indicate greater implementation of DAP in Demonstration than Comparison classrooms.

The most consistent positive differences across years and grade levels were for the Learning Environment scale. Only one of the five differences was not statistically significant. Significant positive differences were also found on the Scheduling scale for first and second grade during the 1994-95 school year, and on the Curriculum scale for first grade (1993-94) and second grade (1994-95). While average scale scores differed significantly between the groups in these instances, there was considerable variation among classrooms within each group on these scales. Hence, even though average scores favored the Demonstration group, some Demonstration classrooms had lower scores than some Comparison classrooms on these scales.

Individual item analysis within scales indicated that in the Learning Environment area children in Demonstration classrooms tended to have a richer array of materials (e.g., language, self-help, math materials) with which to work. They also had more opportunities to access these materials during the school day. In the Scheduling area, Demonstration classrooms were more likely to have a posted daily schedule to which children could refer. There was also evidence of more balance between active and quiet activities in Demonstration classrooms, and more small group activities. In the Curriculum area, children in Demonstration classrooms tended to have more opportunities for active and self-directed learning. For example, in Demonstration classrooms, teacher-led activities were more likely to be followed by child-directed learning activities (i.e., opportunities for the child to select materials and work at his/her own pace with these materials during class time). Teacher-guided discussions in which children were encouraged to participate occurred more frequently in Demonstration classrooms. Finally, in the Interacting area, teachers tended to use more positive behavior management techniques.

While progress in the implementation of DAP was observed, the overall level of DAP implementation in both Demonstration and Comparison classrooms was quite modest. Assessment Profile scale scores have a mean of 50 and a standard deviation of 10. As indicated in Table 1, scale scores fell at or below the mean, with most scale scores in both the Demonstration and Comparison classrooms falling below the mean. In fact, average scale scores for the Learning Environment and Scheduling scales often were about one standard deviation

below the mean or more. Hence, while there was evidence of DAP in the classrooms studied, these classrooms were generally quite far from what might be considered full implementation of DAP.

Relationship of DAP to Student Achievement

The relationship of DAP to student achievement was examined using regression analysis. Spring of 1995 Woodcock-Johnson Broad Reading and Broad Mathematics test scores were regressed on their respective baseline scores (fall of kindergarten) and Assessment Profile scale scores. Baseline Woodcock-Johnson scores were entered in step one of this analysis and Assessment Profile scores were entered in step two to test whether Assessment Profile scores (i.e., DAP implementation) contributed to achievement test score gains. These analyses were carried out in both cohorts. Assessment Profile scale scores were assigned to students according to the classrooms they attended. An average scale score was calculated for each student based on the classrooms the child had attended since kindergarten. These average scores, which were available only for students who continued to attend study schools, were then used in the analysis.

Results of the regression analysis are summarized in Table 3. Findings suggest that DAP contributed significantly to achievement test gains in three of the four analyses conducted -- i.e., mathematics gains in Cohort I and reading and mathematics gains in Cohort II. That is, Assessment Profile scale scores contributed significantly to the variance explained in spring of 1995 achievement test scores after baseline scores were taken into account. In Cohort I, DAP in the Curriculum area was positively linked to mathematics achievement. Further analysis suggests that slightly higher math gains (statistically non-significant) in the Demonstration group than the Comparison group may be related to somewhat higher Curriculum scores in Demonstration first and second grade classrooms. In Cohort II, DAP in the Interacting and Individualizing areas was positively linked to mathematics achievement, although DAP in the Scheduling area was negatively linked to mathematics achievement. This result for the Scheduling scale runs contrary to the general pattern of results which suggest a positive association between DAP and student achievement. Finally, DAP in the Interacting area was positively linked to reading achievement in Cohort II.

Culture, DAP and Student Achievement

We examined whether there were differential effects of DAP upon student achievement by culture (Hmong vs. non-Hmong students). This was done by introducing a dichotomous cultural background variable into the regression equation reported in Table 3, and adding interaction terms (culture x Assessment Profile scales). Given the limited sample sizes, only the Hmong/non-Hmong split was feasible in examining the effects of culture, although the non-Hmong group was fairly diverse culturally. Results of the analysis indicated no significant interaction between culture and DAP in relation to reading or math achievement in either cohort. Hence, it did not appear that the linkage of DAP to student achievement differed across the Hmong and non-Hmong groups.

DISCUSSION

Growing out of Piagetian cognitive theory, many educators have assumed and advocated a positive relationship between DAP and enhanced student learning and achievement. The results reported in this study are preliminary in nature, yet it is encouraging to find significant relationships between DAP in elementary school classrooms and early student achievement in math and reading. It is also of interest that the positive relationships between particular aspects of DAP and reading and math achievement occurred across cultural groups in the sample.

As acknowledged earlier, the degree of DAP implementation was relatively modest, overall. Nevertheless, the Demonstration school classrooms that received DAP training did reflect that training, which focused on the value of classroom design, availability of diverse and engaging materials, and promoting more child-directed learning experiences. The teachers involved in these training workshops were especially enthusiastic about being able to offer students more diverse materials, and sought to create classroom environments which facilitated more independent exploration of the materials. Informal and formal observations of Comparison school classrooms revealed much more limited availability of materials, as well as daily schedules and instruction that relied more heavily upon whole-group, teacher-directed learning experiences.

It must be recognized that varying degrees of exposure to DAP training offered at Demonstration schools during the course of this longitudinal project, as well as individual differences among teachers, undoubtedly affected the levels of DAP implementation. Other issues, such as building-level schedules and faculty turnover may also have contributed to variation of DAP implementation within the Demonstration cluster. It will be important to address these variations in future research in order to establish how richer DAP implementation impacts student achievement in the middle elementary years. To further test the strength of the relationship between DAP and student achievement it will be necessary to examine classrooms which reflect a much higher level of DAP implementation across all five scales of the Assessment Profile. Further examination of how DAP affects students from diverse cultural backgrounds will also provide useful information to elementary school educators and researchers. Finally, it would also be valuable to test achievement among students across a broader range of domains. Although reading and math achievement are critical to overall school success, the theoretical and instructional foundation of DAP supports the value of experiencing a diverse array of cognitive and social/emotional curricula. More authentic and ongoing assessment of student achievement will ultimately better reflect the effects of DAP upon student achievement and academic success.

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Table 1
Developmentally Appropriate Practices in Demonstration and Comparison Classrooms

		Assessment Profile Scale Scores[a]									
		Learning Environment		Scheduling		Curriculum		Interacting		Individualizing	
Grade/Year	N	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)
Kindergarten 1992-93											
Demonstration	11	48.8	(6.3)	44.3	(4.7)	49.2	(4.0)	51.5	(6.7)	50.6	(7.6)
			***								
Comparison	12	37.5	(2.3)	41.6	(5.9)	47.2	(4.8)	52.0	(7.2)	45.9	(0.4)
Kindergarten 1993-94											
Demonstration	16	38.2	(4.2)	38.5	(5.0)	43.2	(3.9)	48.5	(4.3)	49.8	(4.5)
Comparison	13	35.8	(2.3)	39.6	(5.9)	41.6	(3.5)	51.7	(7.1)	47.4	(3.0)
First Grade 1993-94											
Demonstration	11	37.5	(2.4)	36.7	(4.9)	47.6	(5.6)	49.8	(8.6)	51.0	(4.9)
			**				*				
Comparison	11	33.0	(4.1)	38.8	(5.2)	42.2	(3.5)	47.7	(7.3)	49.6	(4.0)
First Grade 1994-95											
Demonstration	15	41.4	(6.2)	42.0	(5.7)	45.0	(6.1)	47.6	(8.5)	46.3	(5.7)
			**		*						
Comparison	13	34.2	(2.9)	37.0	(5.3)	41.0	(3.7)	44.7	(6.7)	44.3	(5.6)
Second Grade 1994-95											
Demonstration	10	39.4	(6.8)	43.3	(4.4)	44.0	(3.6)	44.6	(4.5)	47.7	(6.9)
			*		***		*				
Comparison	10	33.6	(4.2)	34.7	(3.5)	39.5	(5.5)	42.3	(9.9)	46.1	(6.4)

[a] Assessment Profile scale scores are a transformation of ability score estimates from a mean of 0 and a standard deviation of 1 to a mean of 50 and a standard deviation of 10.

* $p<.05$

** $p<.01$

*** $p<.001$

Table 2
Relative Presence of Developmentally Appropriate Practices in Demonstration and Comparison Classrooms

	N[a]	Assessment Profile Scales				
		Learning Environment	Scheduling	Curriculum	Interacting	Individualizing
Kindergarten, 1992-93	23	+11 ***	+3	+2	0	+5
Kindergarten, 1993-94	29	+2	-1	+2	-3	+2
First Grade, 1993-94	22	+5 **	-2	+5 *	+2	+1
First Grade, 1994-95	28	+7 **	+5 *	+4	+3	+2
Second Grade, 1994-95	20	+6 *	+9 ***	+4 *	+2	+2

Note: The scores reported in the table are the Comparison Group score subtracted from the Demonstration Group score.

Assessment Profile scale scores are a transformation of ability score estimates from a mean of 0 and a standard deviation of 1 to a mean of 50 and a standard deviation of 10.

[a] Refers to number of classrooms.

* $p<.05$

** $p<.01$

*** $p<.001$

Table 3
Regression of Spring 1995 Woodcock-Johnson Achievement Test Scores on Baseline Scores and Assessment Profile Scale Scores

	Spring 1995 Woodcock-Johnson Score[a] (Post-test)							
	COHORT I				COHORT II			
	Reading (N=111)		Mathematics (N=110)		Reading (N=159)		Mathematics (N=159)	
Equation	**Beta**	**ΔR^2**	**Beta**	**ΔR^2**	**Beta**	**ΔR^2**	**Beta**	**ΔR^2**
Step 1:		.32***		.23***		.34***		.23***
Respective baseline Woodcock-Johnson score[a]	.57***		.48***		.58***		.48***	
Step 2		.04		.09*		.12***		.20***
Assessment Profile Scale Scores[b]								
Learning Environment	.10		.10		.03		.07	
Scheduling	.05		.14		-.05		-.21*	
Curriculum	.19		.35**		.04		.19	
Interacting	-.06		.03		.32***		.24**	
Individualizing	.12		-.06		.14		.29***	
Total R^2		.36***		.32***		.46***		.42***

[a] Woodcock-Johnson scores are reported as W scores which are a special transformation of Rasch ability scores.

[b] Scale scores are average scale scores for the classrooms which the child attended since kindergarten.

* $p<.05$

** $p<.01$

*** $p<.001$